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A year follow-up prospective post-stroke epilepsy study

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Abstract

Aim: Post-stroke epilepsy (PSE) is a common complication of stroke that can have a significant impact on the quality of life of stroke survivors.

Material and Methods: This cohort study included 15 patients with targeted sampling strategy and collected data using the National Institutes of Health Stroke Scale (NIHSS) scale, laboratory tests, and electroencephalography (EEG). The follow-up period was assessed on the second day and on the first year after stroke. Ethics and informed consent were followed in accordance with regulatory requirements.

Results: Fifteen patients showed onset abnormal EEG results ranging from 8 to 20 NIHSS scores and no significant laboratory deviations on the second day of stroke onset. Levetiracetam (LEV) was administered to these 15 patients, and none of them developed PSE until one year of follow-up.

Discussion: This study suggests that abnormal EEG results on the second day after stroke may be a useful predictor of the risk of developing PSE. Furthermore, administration of LEV to patients with abnormal EEG results may be an effective prophylactic treatment to prevent the development of PSE. Clinicians should consider performing EEGs on the second day after stroke in order to identify patients at high risk of developing PSE. The current results may lead to better screening and prevention of PSE among stroke survivors. If treatment starts prior to the clinical picture of PSE, the outcome is going to be better.

Keywords

Post-Stroke Epilepsy, Electroencephalography, Levetiracetam

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Introduction

PSE refers to the development of epilepsy after a stroke. It is a common complication of stroke, affecting around 10% of the patients. PSE can have a significant impact on the quality of life. Despite its prevalence, much is still unknown about PSE, including its risk factors, underlying mechanisms, and optimal management strategies. The aim of the study is to investigate the use of EEG in predicting the risk of developing PSE and to evaluate the effectiveness of LEV as a prophylactic treatment to prevent the development of PSE in patients with abnormal EEG results. PSE occurs due to the disruption of the normal neuronal network and circuits in the brain caused by a stroke. The exact mechanisms of PSE are not fully understood, but it is believed that several factors contribute to the development of PSE, including the location and size of the stroke and the severity of the stroke. Other factors such as death of inhibitory neurons can be a possible reason for the excitation of neuron clusters and subsequent epileptic discharging. Inhibitory neurons play a crucial role in regulating the excitability of neuronal networks in the brain. They release inhibitory neurotransmitters that dampen the activity of surrounding neurons and prevent them from firing excessively. When inhibitory neurons die or are damaged as a result of a stroke, this can lead to an imbalance in the neuronal network, with an increase in excitation and a decrease in inhibition. This can cause the remaining neurons to become hyperexcitable and more prone to firing in a synchronized and repetitive manner, leading to epileptic discharging and the development of PSE. In addition to the loss of inhibitory neurons, other factors such as the formation of scar tissue and abnormal sprouting of new neuronal connections may also contribute to the development of PSE. Diagnosing PSE can be challenging, as seizures may not occur immediately after a stroke and may be mistaken for other conditions. Understanding the mechanisms underlying PSE can provide valuable insights into normal functioning of the brain.

Material and Methods

Study Design: This study employed a prospective cohort study design to investigate the outcomes of PSE in a sample of stroke survivors with a one-year follow-up period.

Participants: The inclusion criteria were patients aged 18 years and older who had a stroke and were able to provide informed consent, and who had abnormal EEG. The exclusion criteria were patients with a history of epilepsy or seizures before the stroke, those with other neurological or psychiatric disorders, and those who were unable to provide informed consent.

Data Collection: Data were collected at two time points: during the second day after the stroke onset and one year later at the end of the follow-up period. At each time point, data were collected using the NIHSS, laboratory tests, and EEG recordings. The NIHSS was used to assess the severity of the stroke and to identify any neurological deficits or complications. Laboratory tests were conducted to measure biomarkers that may be associated with the development of PSE, including inflammatory markers. EEG recordings were obtained to assess for any abnormalities in brain wave activity that may be indicative of epilepsy.

Toolkit. EEG with 31-channel digital EEG/EP device Neuron Spectrum-64, with sampling frequency: 1000 Hz.

Limitations: This study has some limitations, including small sample size, single-center design, and the limited follow-up period. Additionally, the study may be subject to selection bias, as only patients who were able to provide informed consent were included. Finally, the EEG recordings of stroke patients may not capture all instances of epileptic activity, and additional monitoring methods may be needed to provide a more comprehensive understanding of PSE.

Ethical Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided informed consent prior the enrollment.

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Results

Fifteen patients were enrolled in the study and followed up for one year. The patients were men/women = 7/8 with age from 41 to 88 (average of 67). All of them had abnormal EEG results on the second day after stroke, and their NIHSS scores ranged from 8 to 20. None of these 15 patients had significant laboratory deviations. The treatment protocol included the administration of LEV. During the one-year follow-up period, the incidence of PSE in the entire cohort was 0% (Figure 1). These results suggest that the presence of abnormal EEG results on the second day after stroke may be a useful predictor of the risk of developing PSE and proper inclusion criteria for LEV treatment. Administration of LEV to these patients may be an effective prophylaxis to prevent the development of PSE.

Discussion

The results of this study suggest that the presence of abnormal EEG results on the second day after stroke may be a useful predictor of the risk of developing PSE. Administration of LEV to patients with abnormal EEG results may be an effective prophylactic treatment to prevent the development of PSE. These findings are consistent with previous studies that have shown the value of EEG in predicting the development of PSE [1, 2]. The current study also found that none of the enrolled patients who received LEV developed PSE during the one-year follow-up period. This result is consistent with previous studies that have shown the efficacy of LEV in preventing PSE [3, 4]. However, further studies with larger sample sizes are needed to confirm these findings. The incidence of PSE in this study was 0%, which is not consistent with previous studies that have reported incidence rates ranging from 5% to 20% [5, 6], but all patients were screened by EEG, enrolled and treated before occurring the seizure. This means that if the treatment starts

Figure 1. Timeline of the study - Fifteen enrolled risk patients for PSE, treated by LEV with 0% incidence of PSE at the one-year follow-up endpoint

prior to the clinical picture of PSE, the outcome is going to be better. One limitation of our study is the small sample size, which may limit the generalizability of our findings. Another limitation is the limited follow-up period of one year, as PSE can develop years after the initial stroke [7]. Additionally, the sample was selected with a targeted strategy, which may introduce selection bias.

Conclusions

In conclusion, the study suggests that clinicians should consider performing EEGs on the second day after stroke in order to identify patients at high risk of developing PSE. For patients with abnormal EEG results, the administration of LEV may be an effective prophylactic treatment to prevent the development of PSE. If the treatment starts prior the clinical picture of PSE, the outcome is going to be better.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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